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ABSTRACT

Using hands-on activities and the "Plan, Do, Review" approach, this physics curriculum for 3-year-old children is designed to develop an early interest in and enthusiasm for science and to excite children about learning in general. The curriculum is designed to be implemented biweekly in preschool or child care programs but may also be presented at a science center or museum. The introduction to the curriculum describes its philosophical underpinnings and the general structure for learning sessions. Part 1 of the curriculum presents four activities conveying the following concepts: (1) magnetic attraction; (2) energy as a power source; (3) light as a source of color; and (4) gears making it easier for motors to work by transferring energy. Each activity description details the scientific concept, delineates instructional procedures, and lists additional activities. The sessions begin with a group time, including a story to introduce the relevant concept. Teachers introduce children to possible activities, and place materials in learning centers. Adults join children in learning centers, engaging them in questions intended to enhance their understanding. After activities have been completed, children return to group time to share their activities. Part 2 of the curriculum contains additional instructions for each activity and some of the materials used. Part 3 lists books and presents fingerplays and songs relevant to physics principles and appropriate for preschool children. (KB)

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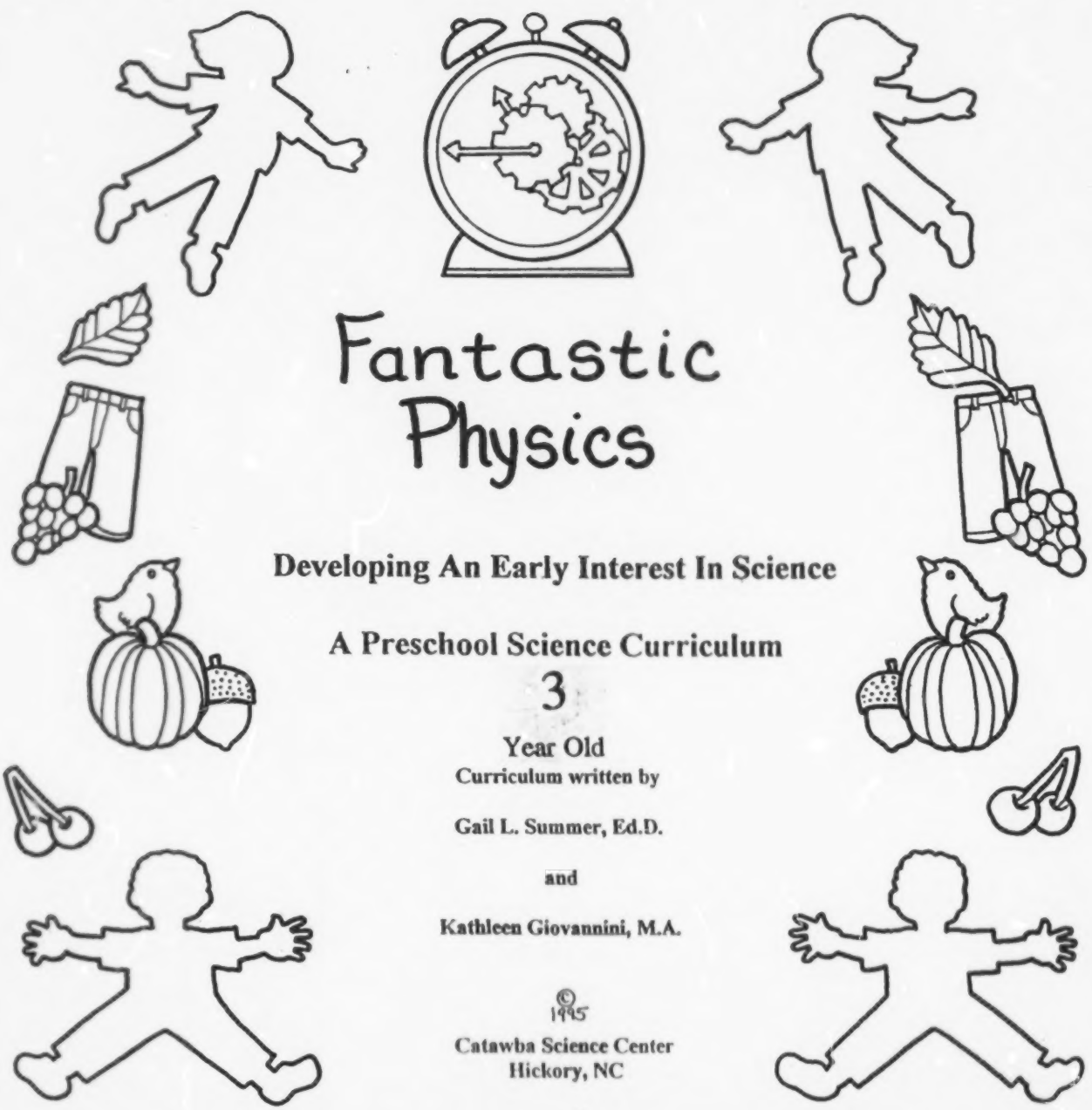

Fantastic Physics

Developing An Early Interest In Science

A Preschool Science Curriculum

3

Year Old

Curriculum written by

Gail L. Summer, Ed.D.

and

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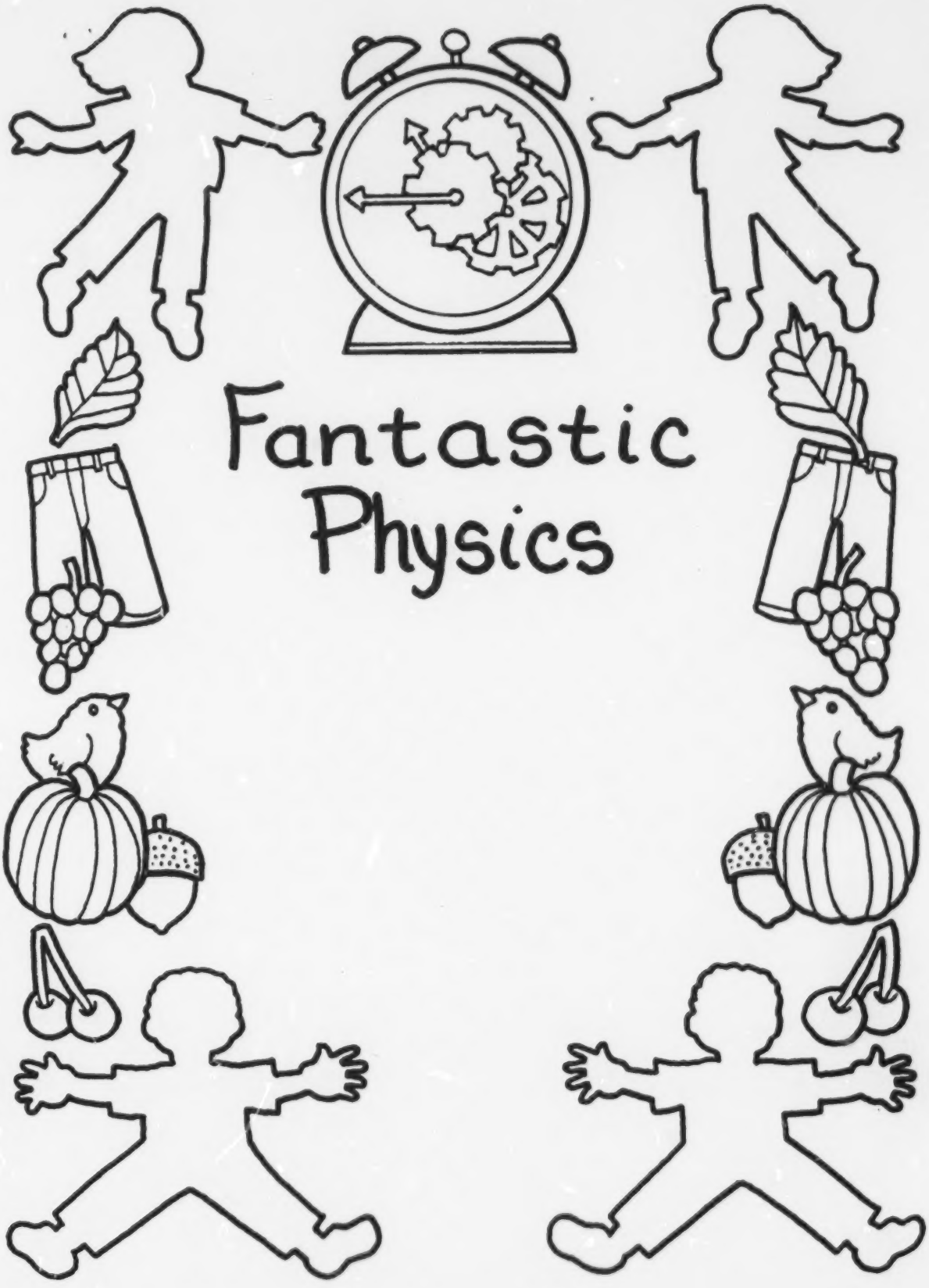

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Introduction

Philosophy

Developing an Early Interest in Science has been designed to not only develop an early interest in and enthusiasm for science, but also to excite young children about learning and discovering in general. While science is the content, the approach with which that content is presented is crucial to the success of developing an early interest in science and learning.

The young child learns in unique ways. The young child must experience science concepts. Simply talking about scientific concepts doesn't allow the child to understand and therefore attach meaning to the concepts. Perhaps the old Chinese Proverb, "I hear and I forget; I see and I remember; I do and I understand" is a good reminder of how the young child needs to experience the world. Doing is the key.

Given how the young child learns, **Developing an Early Interest in Science** is based on a modification of the Plan, Do, Review approach devised by High Scope in Ypsilanti, Michigan. The Plan, Do, Review approach introduces the concept and choices for the day, then allows each child to "plan" their activities by stating their choices for that day. After each child "plans," each implements his/her plan by "doing," or engaging in the activities selected. While the children are "doing," the teachers are interacting with them, asking questions to further elaborate the learning. After "doing," the children regroup and "review" by sharing what they did while interacting with the activities that day. The purpose of the Plan, Do, Review approach is to allow children control over their learning, while still holding them responsible for what they are learning.

Program Description

Developing an Early Interest in Science has been designed to be an outreach early childhood program. In its original form, a science educator from the Catawba Science Center in Hickory, NC visited child care/early childhood programs on a bi-weekly schedule. With each visit, one session was shared with the children. Teachers in the child care programs participated in training workshops prior to each new unit (units consisted of 4-6 sessions). The purpose of the workshops was for the teachers to make resource activities they used in their classroom after the session and to also gain an understanding of the concepts to be better able to assist the science educator while she was in their classroom.

Replication of the program in its original form is possible, but variations are also possible. The sessions could be presented at a science center with the children travelling to the museum rather than the educator travelling out to the children. The sessions may also be presented to small groups of parents and their preschoolers at a science museum for a brief morning session, somewhat similar to the library story hour idea enjoyed by parents and preschoolers for years. The sessions are also easily adaptable by teachers in child development centers for use in their own classrooms. Each session provides suggestions for numerous center ideas to enrich science activities throughout the preschool curriculum. With a little flexibility, the curriculum presented here can fit many formats and needs.

Session Description

In **Developing an Early Interest in Science,** each session begins with a circle or group time, with a song to say hello to everyone, and a story to introduce the concept for that

session. Children are then introduced to all the possible activities for the session. As the activities are shared, they are placed in learning centers around the room. After the activities are all introduced, and the children have watched where each has been placed in the learning centers, the children "plan" as they are asked one by one what they would like to do during that day's session. (This whole introductory process takes about 10 minutes.)

As children make choices, they are dismissed from the circle to begin the "do" part of the cycle by engaging in their choices in the learning centers. Adults join the children in their activity in centers by floating from center to center to engage children in questions which enhance their activity and understanding. As children complete one activity, they may choose another activity in their plan. Children are not expected to rotate through the activities on an adult schedule or in groups of prearranged partners. Some children may only complete one activity during a session due to total engagement with that activity, and that's just fine. Other children may complete several activities and that's acceptable too. There is no predetermined number of activities which should be completed and no child is forced to interact with a particular activity.

After the time for "doing" has been completed (usually about 25 minutes), the children return to the circle group time to share ("review") what they did in centers. The teacher often helps this process by asking "Johnny, what did you play with in centers today?" When a child has a hard time remembering, or is quiet and unsure of reviewing at first, the teacher can help by suggesting, "Did you play with the magnets today? What happened when you used the magnet?" The teacher is able to ask Johnny about his "plan" because she floated through the centers and observed what each child did. (Reviewing takes about 5 minutes.) After each child has had a chance to review, the concept for the session is reemphasized or recapped by the teacher, and the session is ended.

Activities

The activities which are included in **Developing an Early Interest in Science** are all hands-on, manipulative activities. Every effort is made to make the concept for each session real and meaningful for children by allowing them to experience it. For example, rather than just talk about the fact that water flows because it is a liquid, the children actually pour water through clear tubes and watch the flow in action. Rather than talk about internal body parts children can't see, special dolls are used which allow children to uncover those hidden inside body organs such as hearts and lungs. Whenever appropriate books and puppets are used to enhance language. Science develops wonderful vocabulary! Puzzles are used to help children develop fine motor skills and explore science.

Real materials are used whenever possible. Real butterfly displays are explored rather than exclusively using colored pictures of butterflies. Real rocks of a wide variety are provided. Both real and replica fossils are manipulated. There is much to be said for allowing children to experience the "real thing." Yes, some science materials are fragile, but children will never learn to be careful unless there is reason to be so. Imagine touching and feeling a real fossil from a dinosaur! It takes little enticement to be gentle with a thing so old, if children are only reminded just how precious fossils are.

Resource Activities

Developing an Early Interest in Science has also been designed to include resource or enrichment activities to further extend the concepts from each session. Some resource

activities suggest the use of real objects easily obtainable. Many other resource activities are made with patterns to produce manipulative games with which to review session concepts. Masters of the patterns and directions for their use are included with the curriculum. A brief listing of the resource activities made from the patterns along with additional suggested activities can be found in the session descriptions. More detailed directions for assembly of patterns to make the resource activities can be found in the teacher resource activity section. Lists of suggested books, fingerplays, and songs to be used by the classroom teacher in order to infuse the science concepts throughout the child's day are also included in a separate section of the curriculum.

Using **Developing an Early Interest in Science**

Whatever format meets your particular needs, it is important that you read the session through before trying it. As you read the session procedure, try to picture how and where you will lay out the center activities. Review the storybooks suggested and read them before the sessions. Practice the fingerplays before the session too. Anticipate the questions children will ask. Perhaps most important, get excited about what you will be sharing with the children! Your enthusiasm is contagious!

A suggested list of materials used in the centers is included with each unit. From time to time, materials are discontinued by manufacturers. If this should happen before you can access the materials suggested, review the session to determine how that particular material was used and select a substitute item. While the materials suggested worked well, there's nothing to say that a substitute item might not do just as well or even better.

Most important in using **Developing an Early Interest in Science** is to encourage children to play, interact, and enjoy. An early interest in science cannot be developed if children are chastised for messes and trying something that wasn't the adult intention. Science requires hypotheses and tests for hypotheses. Children are natural "little scientists" if allowed to explore. So relax and watch those little scientists blossom!

Fantastic Physics

Session Activities

Three-Year-Olds

FANTASTIC PHYSICS

Three-Year-Olds

Session 1

CONCEPT: Magnets attract special substances. (The children will experiment with the attractive properties of magnets.)

PROCEDURES:

1. Gather the children in a circle group. Open with a name fingerplay to distribute name tags/learn names. Immediately move into a fingerplay to introduce the day's concept.

2. Next, begin by introducing two large magnets that are stuck together. Challenge a child to pull one magnet away as you hold the other one. Ask the children why they think it was hard to pull the magnet away. Then, talk about how a magnet "sticks" to special things made of certain metals. Show the children how the big magnet won't stick to you or the wall or a child's clothes. Introduce the word "attraction" by explaining that certain items are attracted to or drawn toward each other.

3. Next, pass out the magnetic wands to each child. Encourage the children to stick their wand to another child's wand and gently pull apart to feel the attraction. Ask the children if they feel the attraction. Ask them if they feel an attraction between their clothes and the magnet.

4. Then, pass out assorted "junk" (some metallic, some not) for pairs of children to experiment and see what "sticks." Ask the children to help you sort out what attracts from what does not attract. After the sorting, allow the children to tell about the things that stuck to the magnet and the things that did not. Be sure to explain that not all metallic things stick to the magnet. Ask the children to try and explain why, then you explain that it is the types of metal that the things are made of that allow them to stick.

5. Review with a fingerplay to resettle the group and prepare to disperse to centers. Once attention is regained, explain the center options available for that day. After you have explained the centers, ask the children to choose where they would like to go. As they choose, send them on their way. Allow the children to freely play and choose another center as they finish each task. Encourage the children to "discover" something at each center. Be sure to float from center to center and interact with the children as they play to reinforce the concepts for the day. The center choices today are:

A. Provide the magnetic blocks in a center. Tell the children these blocks are different from other blocks because they have something special in them. Encourage the children to discover how the blocks stick together and experiment to see what they can build with them. Allow 3 children at this center.

B. Provide the big magnet and magnetic marbles out in a center. Ask the children to find out which is the magnet: the marbles or the large magnet (of course, both are!) Let children experiment with the magnetic attraction of each. Ask the children to see how many marbles they can get in a chain. Allow 2 children in this center.

C. Provide the magnetic fishing pole and fish in a center. Will the pole "catch" any fish? Why? Allow 3 children in this center.

D. Provide the Magnadoodles in a center. Let the children draw with the pencil and the shaped magnets. Ask the children why they think the special pen and shapes make marks on the board? Allow 2 children in this center.

E. Provide the magnetic wand and the assorted junk for the children to sort again. Ask the children to find out which objects "stick" to the magnet. Ask the children why they think the objects "stick" to the magnet. Allow 3 children at this center.

F. Provide a magnetic board and assorted magnetic common object shapes in a center for the children. Encourage them to use the shapes to create a picture on the board. What is in the shapes to make them stick to the board? Allow 2 children at this center.

G. Provide assorted geometric magnetic shapes and another magnetic board in a center. Ask the children how these shapes stick to the board. Can you make a body with the shapes? Allow 1 child in this center.

H. Provide the Magnet Marvel in a center. (The Magnet Marvel is a board with an assortment of objects, each in their own space, under a Plexiglas cover. An attached magnetic wand is meant to be used to discover which items will stick to the magnet through the Plexiglas.) Ask the children to predict which objects the magnet will "attract" through the clear Plexiglas cover. Then let the children test their prediction. Allow 1 child in this center.

I. Provide the Magnet Discovery Board in a center. (The Magnet Discovery Board is essentially the same as the Magnet Marvel.) Which objects will the magnet "attract" through the clear Plexiglas cover? Allow 1 child in this center.

6. Two minutes before you are ready for the children to clean up, turn out the lights and make an announcement to warn them to begin finishing up whatever they are working on. After two minutes, turn out lights again and ask the children to clean up. Call children

back to the group circle with a song. Allow each child to share one thing they learned or played with during center time.

7. Close by reviewing the word attraction, and discussing why some metals "stick" to magnets and others do not. Allow the children to review which objects stuck and which did not.

8. Sing a good-bye song and collect the name tags.

RESOURCE KIT:

1. Leave behind three magnetic wands.

2. Leave behind some of the "junk" assortment used in the session.

3. Leave behind one mini magnadoodle.

4. Leave behind 15-20 magnetic marbles.

5. Suggest that the classroom teacher make a fishing pole with a magnet on th end of the string. (See teacher resource packet for directions.)

FANTASTIC PHYSICS

Three-Year-Olds

Session 2

CONCEPT: Some things need energy to make them work. (The children will become familiar with the concept that energy is a source of power which allows things to function.)

PROCEDURES:

1. Gather the children in a circle group. Open with name fingerplay to distribute name tags/review names. Introduce the day's concept with a fingerplay.

2. Review the body unit by talking about the session on foods. Why do we eat food? We need food to make our bodies work - food gives us energy. Ask the children what kind of work our bodies can do if we have energy. (Run, walk, think, play, grow.) Then ask them how other things work. A car needs gas to make the motor work - the motor needs energy. Plants need water and light to grow: water and light give plants energy.

3. Next, show the solar panels and toys. Ask the children to tell you how we can make them work. With a reflector reading light, demonstrate that the light will make the toys work. Tell the children that light is energy. But what makes the reading light work? Explain that electricity is energy, too. Not all electrical energy comes from an electrical outlet. Batteries provide stored electrical energy.

4. Then, tell the children that not all electrical energy comes from an electrical outlet. Batteries provide stored electrical energy. Show the children the battery operated toys. Ask the children how we can make them work. Batteries. Show the children where the batteries are in the toys. Ask them what they think happens when the batteries no longer have energy. Demonstrate where the batteries fit and how each toy works.

5. Next, explain that other toys don't use batteries - you wind them up. Tell the children that winding is another kind of energy called mechanical energy. Demonstrate the wind up toys. As you are winding the toys ask the children to tell you what kind of energy this is called to remind the children of mechanical energy.

6. Review that energy makes things go. Discuss the different types of energy you have talked about today: solar energy, electrical energy, and mechanical energy.

7. Do a fingerplay to resettle the group and prepare to disperse to centers. Once attention is regained, explain the center options available for that day. After you have explained the centers, ask the children to choose where they would like to go. As they choose, send them on their way. Allow the children to freely play and choose another center as they

finish each task. Be sure to float from center to center and interact with the children as they play to reinforce the concepts for the day. The center options today are:

A. To allow experimentation with light as an energy source, provide three solar powered toys in a center. Let the children make them work with the reflector reading light. Talk to the children about light being the energy that makes the toy move. What happens when you cover part of the solar panel with an index card? Why does the toy slow down? Allow 6 children at this center.

B. To allow experimentation with stored electrical energy, provide at least six battery operated toys and flashlights in this center. Let the children remove and replace the batteries in the toys and flashlights to make them work. Be sure to help the children notice what type of energy is making the toys move. Allow 6 children at this center.

C. To allow experimentation with mechanical energy, provide at least a dozen wind up toys in this center. Let the children wind up the toys to make them work. Ask the children what kind of energy the wind up toys are using. Remind them of the other types of energy. Allow 6 children at this center.

8. Two minutes before you are ready for the children to clean up, turn out the lights and make an announcement to warn them to begin finishing up whatever they are working on. After two minutes, turn out lights again and ask the children to clean up. Call children back to the group circle with a song. Allow each child to share one thing they learned or played with during center time.

9. Close with the different types of energy you discussed today. Ask the children to help you remember the different types. (i.e. food, solar or light, battery or electrical, and mechanical) Hold up the different toys and allow the children to tell you what kind of energy the toy uses. Close by asking what the toys needed today in order to work. (The toys needed energy.)

10. Sing a good-bye song and collect the name tags.

RESOURCE KIT:

1.Provide each classroom with two solar cells, two motors, two propellers, two 5 x 7" masonite boards, and two bathroom size plastic cups. Directions for assembling the solar boards are in the teacher resource packet.

2. Provide each classroom with two D-size battery holders, two light bulb holders, two flashlight size light bulbs, and two 5 x 7" masonite boards. Directions for assembling the light bulb circuits are in the teacher resource packet.

3. Provide each classroom with two nine-volt battery clips, two three-volt buzzers, and two 5 x 7' masonite boards. Directions for assembling the buzzer boards are in the teacher resource packet.

4. Suggest that the classroom teacher provide a battery operated vehicle, paint, and paper to drive the vehicle through the paint to paint.

FANTASTIC PHYSICS

Three-Year-Olds

Session 3

CONCEPT: Light makes color. (The children will become familiar with the concept that colors come from light .)

PROCEDURES:

1. Gather the children in a circle group. Open with a name fingerplay to distribute name tags/review names. Introduce the day's concept with a fingerplay.

2. Read Is It Red Is It Yellow Is It Blue? Ask the children to watch for the different colors and to help you identify them.

3. Next, ask the children what makes colors. Ask if they have ever tried to color in the dark. Review with the children that light is a source of energy. Tell the children that we also depend on light for something else in our world. We need light to see colors. Hand each child an unbreakable prism. Have children look at light/window through the prism. Ask if they see anything. (Rainbow colors.) Emphasize that light makes the colors. Ask the children to help you name the colors that they see.

4. Then, lay out the plastic bar graph to graph colored cubes by color. Name the colors as you go. When the graph is finished, ask the children of which color cube there was the most; the least.

5. Introduce to the children that sometimes we mix colors to get other colors. Read Mouse Paint and ask the children to listen for the colors that the mice mix. Demonstrate mixing colors by using the color mix tubes from Lakeshore by shaking them to make the secondary colors. Name the primary colors you are mixing before you shake! Ask the children to identify which colors you have made.

6. Review with the children that light is special because it is an energy source and that light also makes color. Talk about the colors that the prism makes.

7. Do a fingerplay to resettle the group and prepare to disperse to centers. Once attention is regained, explain the center options available for that day. After you have explained the centers, ask the children to choose where they would like to go. As they choose, send them on their way. Allow the children to freely play and choose another center as they finish each task. Be sure to float from center to center and interact with the children as they play to reinforce the concepts for the day. The center options today are:

A. Provide the Teddy Bear Color Bingo game in a center for the children to play with an adult. Encourage children to name the colors they match. Allow 4 children at this center.

B. Provide assorted puzzles in a center and talk to the children about the colors as they complete the puzzles. Allow 2-3 children at this center.

C. Provide the Ravensburger Color Match Balloon game in a center. Ask the children to roll the die and select a balloon to match to their lotto board. Name the colors as the children play. Allow 4 children in this center.

D. Provide the color paddles in a center and encourage the children to make new colors by "mixing" the paddles. Ask the children to tell you which colors put together make new colors. Also, ask them to tell you the different colors. Allow 3 children in this center.

E. Provide a variety of color books in a center for the children to read. Encourage the children to identify the different colors that they see. Also, encourage them to try and think if primary colors are needed to make these colors. Allow 2 children in this center.

F. Provide sorting buckets and assorted colored objects in a center. Let children sort the objects by color into the buckets. Ask them to identify the colors as they are putting them in the buckets. Allow 3 children at this center.

G. Provide the colored cubes and plastic bar graph in a center for the children to graph by color as was done in the group time. Encourage the children to identify the colors as they graph them. Allow 2 children at this center.

H. Provide the color mix tubes in a center. Help the children to mix the colors by reminding them to use the primary colors to make other colors. Ask the children to identify the colors that they make. Allow 2 children at this center.

8. Two minutes before you are ready for the children to clean up, turn out the lights and make an announcement to warn them to begin finishing up whatever they are working on. After two minutes, turn out lights again and ask the children to clean up. Call children back to the group circle with a song. Allow each child to share one thing they learned or played with during center time.

9. Review the primary colors and how light makes color. Ask the children to discuss what colors they mixed to make new ones.

10. Sing a good-bye song and collect the name tags.

RESOURCE KIT:

1. Provide each classroom a set of color paddles.

2. Use the patterns to make a colored object lotto game for children to match different objects which are the same color. See the teacher resource packet for directions.

3. Provide a large kitchen trash bag and colored masking tape with which a bar graph can be made. Provide colored tracers for graphing.

4. Suggest that the classroom teacher encourage further experimentation with color blending by having children paint over torn pieces of tissue paper with liquid starch on white paper.

5. Suggest that the classroom teacher provide pieces of colored cellophane for the children to look through.

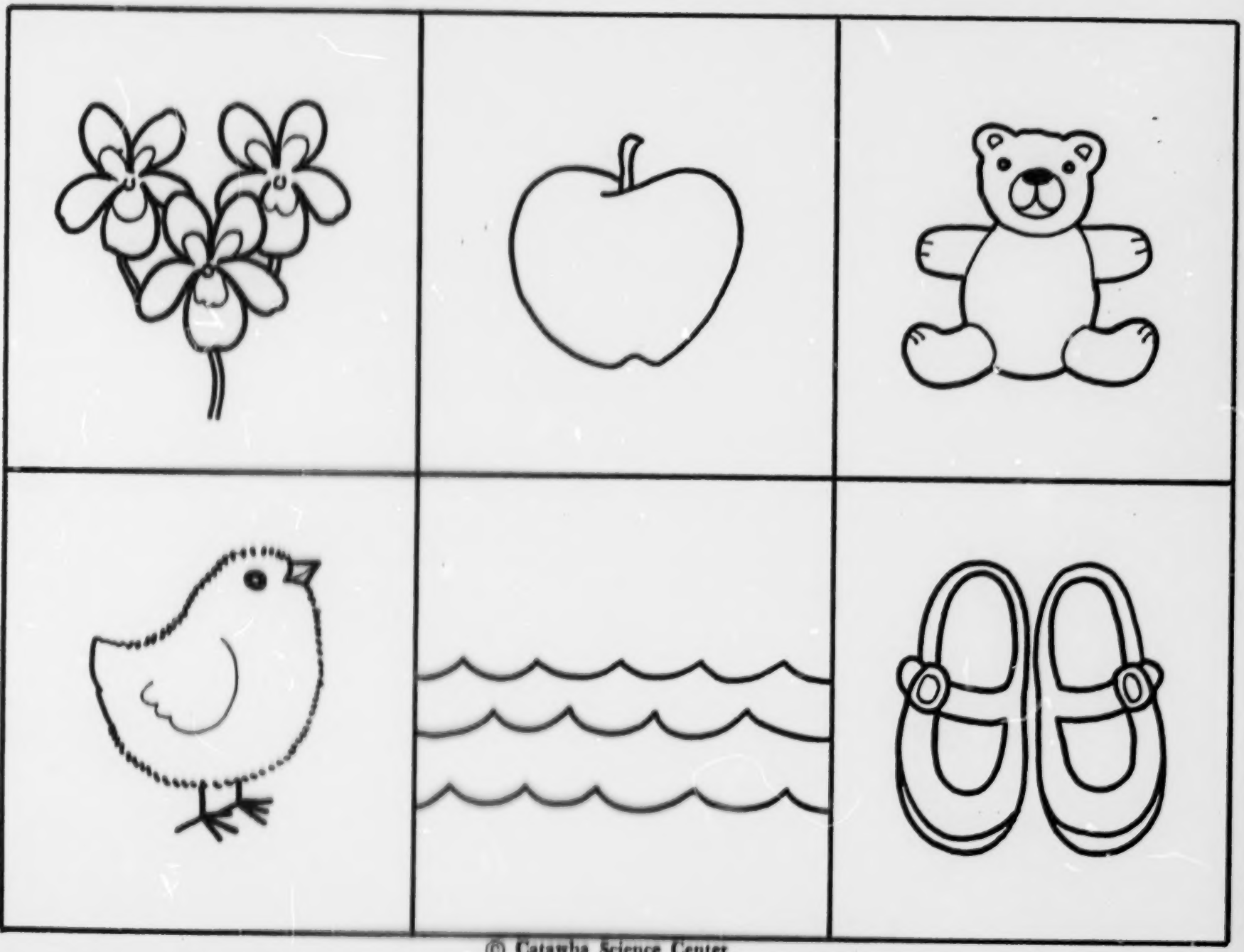
6. Suggest that the classroom teacher set up a color box. Each day, the color box should feature a different color. The children collect/find objects throughout the day to place in the box.

7. Suggest that the classroom teacher provide magazines and plain paper. The children cut or tear out pictures to glue into a class color book.

8. Suggest that the classroom teacher make a snack to match the color of the day.

9. Suggest that the classroom teacher provide coffee filters and food coloring to experiment with color mixing and absorption.

10. Suggest that the classroom teacher provide an assortment of paint color combinations at the easel or art center for color mixing fun.



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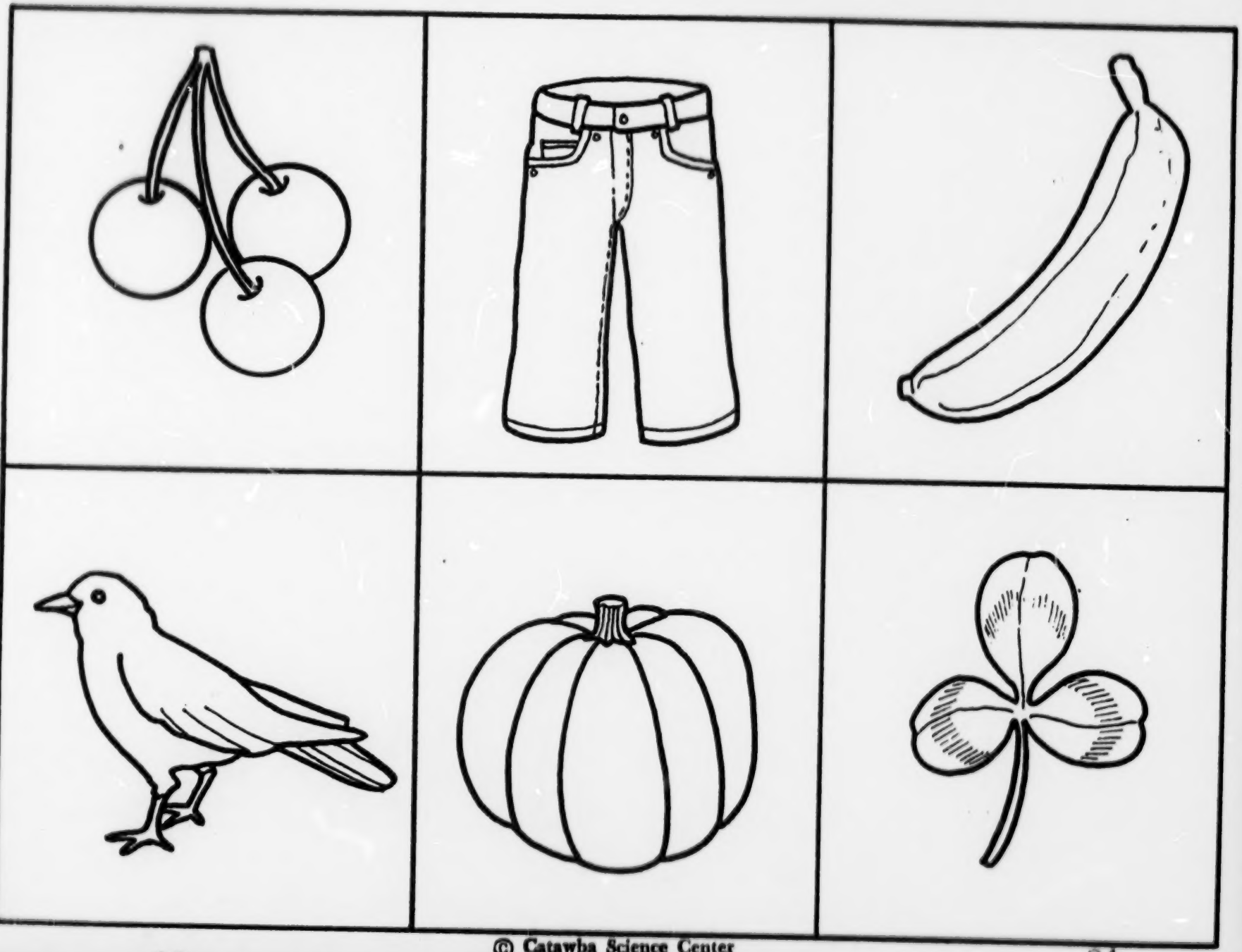

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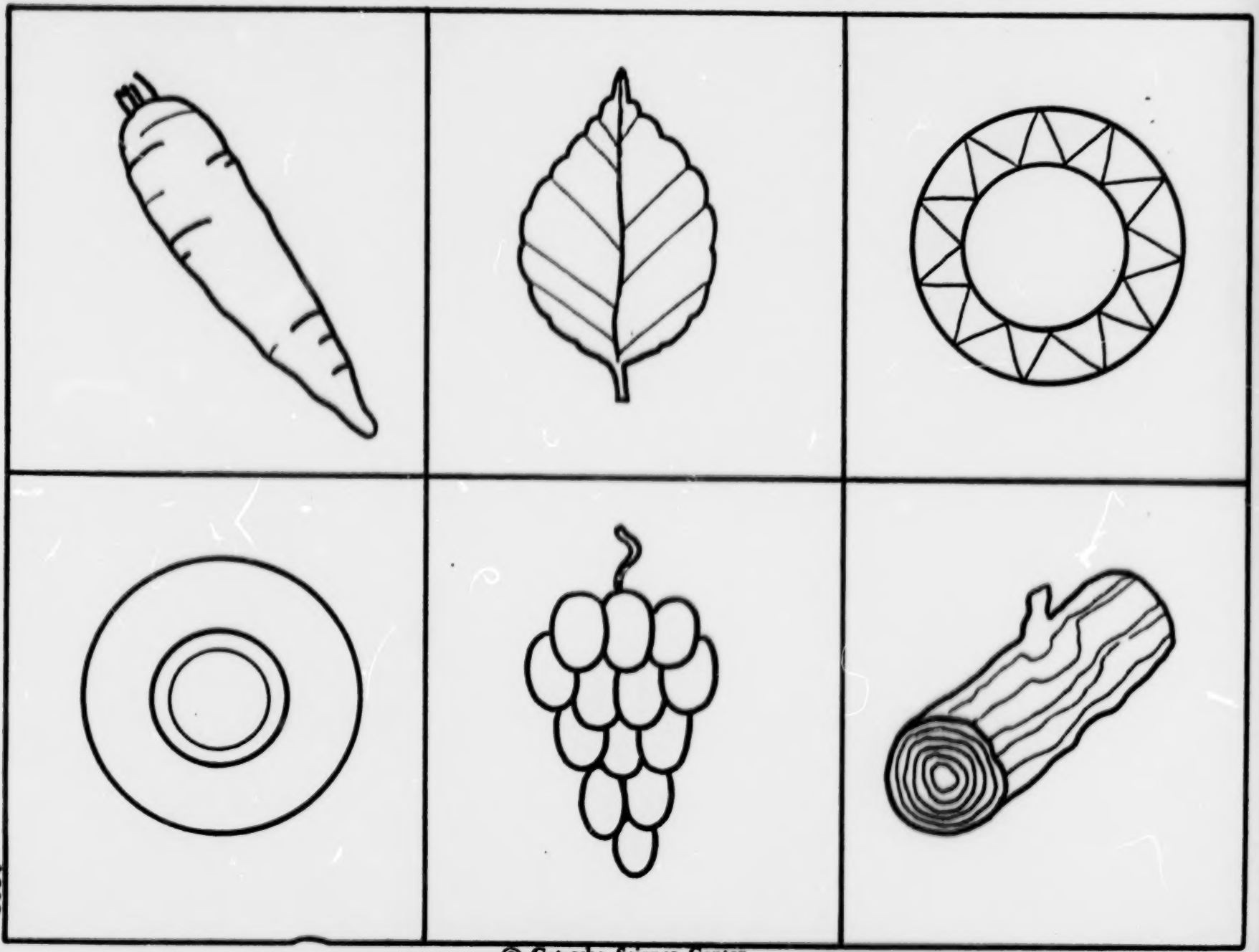

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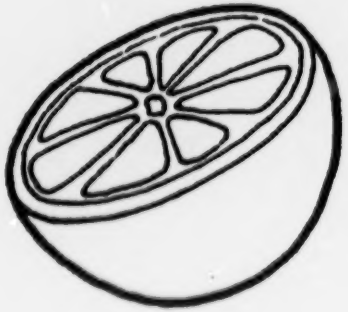

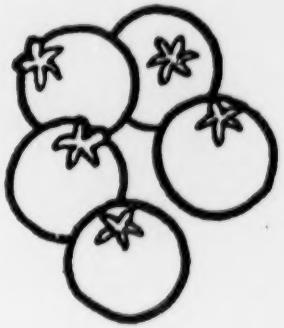

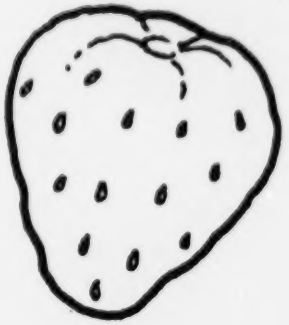

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FANTASTIC PHYSICS

Three-Year-Olds

Session 4

CONCEPT: Gears help us do work. (The children will become familiar with the idea that many motors have gears in them, and that gears transfer energy, or make it easier for motors to work.)

PROCEDURES:

1. Gather the children in a circle group. Open with a name fingerplay to distribute name tags/review names. Introduce the day's concept with a fingerplay.

2. Reintroduce the wind-up toys from the energy lesson and ask the children how they worked. Ask the children to predict what happened inside when you wound the toy up to make it go. Demonstrate what happens with the see-through lion and dinosaur by turning the toys on and asking the children to watch the special wheels inside go as they move. Also demonstrate with a wind-up toy you have opened so children can actually see inside.

3. Next, ask the children what 's special about the wheels? (They are not smooth, they have teeth.) How do the wheels move? (The teeth mesh and then the wheels move together.) Allow the children to answer first before you give them the information.

4. Then, introduce the word gear and explain that many motors have gears inside that make the parts of the motor work. When the gears are put together so the teeth all mesh, you turn one and all the gears turn. The gears help us work. Demonstrate with the wonderwheels how the gears mesh and turn together.

5. Tell the children that today they will be playing with all kinds of gears. Explain the center options available for that day. After you have explained the centers, ask the children to choose where they would like to go. As they choose, send them on their way. Allow the children to freely play and choose another center as they finish each task. Be sure to float from center to center and interact with the children as they play to reinforce the concepts for the day. The center options today are:

A. Provide the see-through dinosaur and lion in a center and allow the children to freely play. Ask the children to watch the gears at work. What do the gears make move on each toy? Allow 3 children at this center.

B. Provide Playskool Busy Gears in a center. Allow the children to place the large gears on the board so they all mesh. Ask the children to turn the handle and find out what happens. Allow 3 children in this center.

C. Provide Gobs of Gears in a center. The gears are velcroed and may be freely moved on the board. Use the gears to build something so that all the gears work. Make sure the children remember to mesh the gears so that when they are finished, only the crank will need to be turned to make all the gears go. Allow 3 children in this center.

D. Provide the Wonderwheels in a center. This set of gears are the easiest to make work, because they automatically mesh and turn together. Remind the children that this is how the wind up toys work. Allow 5 children in this center.

E. Provide Toot-toot Sports Car and Helicopter in a center. Let the children wind up the toys. Ask them to watch what moves inside. Ask them what the gears turn on the vehicles. Allow 2 children in this center.

F. Provide Duplo pull-back motors and Duplo building blocks in a center. Allow the children to construct vehicles on the pull-back motors. Ask them to predict what makes the pull-back motors work. What do the gears help move on the pull-back motors? Allow 3 children in this center.

G. Provide Gears, Gears, Gears in a center. The children snap together the base boards and then snap on the gears. The gears automatically mesh and will make each other turn. Stay with flat designs with this age group. Allow 2-3 children in this center.

7. Two minutes before you are ready for the children to clean up, turn out the lights and make an announcement to warn them to begin finishing up whatever they are working on. After two minutes, turn out lights again and ask the children to clean up. Call children back to the group circle with a song. Allow each child to share one thing they learned or played with during center time.

8. Sing a good-bye song and collect the name tags.

RESOURCE KIT

1.Provide each classroom with a set of Wonderwheels.

2. Suggest that the classroom teacher bring in common objects which use gears to work.

Fantastic Physics

Teacher Resource Activities

Three-Year-Olds

Physical Science
Resource Kit
Three Year Olds

Session 1: Magnets attract special substances.

1. Use the magnetic wands to see if different objects in the classroom "stick" to the magnet. Use buckets to let children sort the things that will stick from the things that won't.

2. Put out the bag full of assorted junk for children to use with the magnets. Again, these can be sorted. To the collection in this bag, add some common classroom objects such as buttons, scissors, popsicle sticks, keys, chalk, rocks, erasers, and pennies. Help children look for some common characteristics among those items that stick and those that don't.

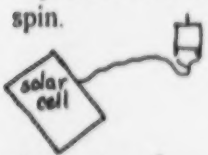
3. Let the children draw with the mini Magnadoodles. Remind the children that they are drawing pictures with metal particles that stick to the magnet.

4. Let children explore with the magnetic marbles. They can all be hooked together, they can stick to other magnets, they will stick to the same things as the magnetic wands.

5. Fishing poles can be made using long wooden dowels. Tie a circle magnet to a string and then use a thumbtack to attach the other end of the string to the dowel. To make fish, cut various fish out of paper and laminate, or use wallpaper scraps. Attach paper clips to the fish, and let children catch the fish with their poles. This activity can be extended in a variety of ways. Make the fish in a variety of colors and let children sort the fish by color as they are caught. Instead of colors, each fish can have a shape drawn on it. Children can fish to find shapes that are the same.

Session 2: Some things need energy to make them work.

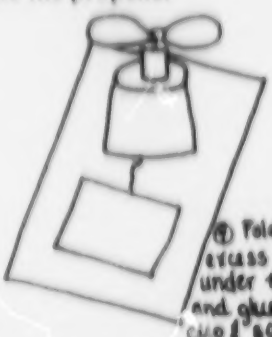
1. Use two solar cells, two motors with propellers, two bathroom size plastic cups, and two 5"x 7" boards. For each unit, connect the solar cell wires to the motor. Cut a hole just large enough for the motor in the bottom of the small plastic cup. Set the motor in the hole. Hot glue the motor in the hole. Hot glue the solar panel and the top edge of the cup to a 5"x 7" board. The children expose the panel to sunlight to make the propeller spin.



① attach wires from solar cell to bottom leads on motor - they should slide right on.

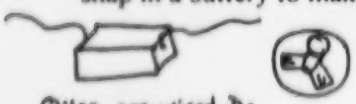
② cut a hole about the size of a nickel in the bottom of the cup

③ Feed the motor up from under the cup into the hole. Hot glue at the hole to keep the motor in place

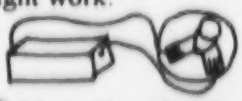


④ Fold the excess wire under the cup and glue the cup & solar panel to the 5x7" masonite board.

2. Use two battery holders, two light bulb holders, two light bulbs, and two 5"x 7" boards. For each unit, wire a battery holder to the easy clips on the light bulb holder. Hot glue the battery holder and light bulb holder to a 5"x 7" board. Insert a light bulb. The children snap in a battery to make the light work.



①Use pre-wired D-size battery holders and a flashlight bulb size bulb holder.



② Attach the wires to the bulb holder. Strip the ends of the wire first. Then, simply push down on the clips on the bulb holder & slide the bare wire end in. Let go on the clip!

③Glue the battery and bulb holders to the 5x7" masonite board.

3. Use two 9 volt battery clips, two 3 volt buzzers, and two 5"x 7" boards. For each unit, pre-solder the battery clip wires to the buzzer wires. Tape with electrical tape. Hot glue the buzzer to a 5"x 7" board. The children simply touch the battery clip to the top of a 9 volt battery to make the buzzer buzz.

① Use a 3 volt buzzer & a 9-volt battery clip.

② Solder the buzzer wires to the battery clip wires.

③ Glue the buzzer to the 5x7" masonite board.

4. Paint with a battery-operated toy. Lay white paper on the bottom of a box. Place spoonfuls of paint on the paper. Turn toy on and let it run through the paint. Try using two or three different colors at a time. Remove battery to rinse car carefully. This can also be done with a wind-up toy. Remind children of the energy it takes for the car to move. It also takes energy for us to paint.

Session 3: Light makes color.

1. Let children use the color paddles to mix colors to make new ones. After they have done this, provide children an opportunity to mix paints that are the same colors as those in the paddles. Help children predict what will happen as they are mixed together.

2. Use one copy of each pattern numbered P332. Color the pictures on each sheet their natural color. Cut the pictures apart. The children should match the pictures by color.

3. Make a graph using the large garbage bags and the colored masking tape. Use the tape to make a grid on the plastic bag. Lay this graph on the floor to use with the children. Tape a red, yellow, blue, and green square of construction paper at the bottom of each column. Hand out the color tracers to the children. Make sure that there are not equal

numbers of colors. Let children take turns placing their tracer on the appropriate box on the graph. One tracer goes in each box. Help children compare the columns. Talk about which is longest and which is shortest. Explain how we can tell which color tracers there are most of and least of by looking at the graph.

4. Tear several colors of tissue paper into small pieces. Let children paint on white construction paper with liquid starch and then stick the tissue paper onto it. Encourage children to overlap colors to make new colors.

5. Cut red, yellow, and blue cellophane paper into 4" squares. Give one to each child. Let child look through cellophane at their friends, the teacher, their clothes, and objects around the room. Talk about how the colors of things in the room changed. Next, let each child put two colors together and notice what happens to the colors of things in the room.

6. Each day, have a color box highlighting a different color. Let children find objects around the room that are the color of the day and that fit into the box. At the end of the day count the items. Make a large graph out of chart paper and hang on the wall. Have a column designated for each color (red, yellow, blue, green, orange, purple). As each item is counted, fill in a square in the appropriate column using corresponding markers. Once all colors have been featured, compare the finished graph with the children.

7. Let children make a color book. Each page should be labeled with one color. Children can glue magazine pictures (pre-cut or cut themselves) of items onto the appropriate page. Label the items and staple together all the pages into a book for children to read.

8. Make a snack that matches the color of the day.

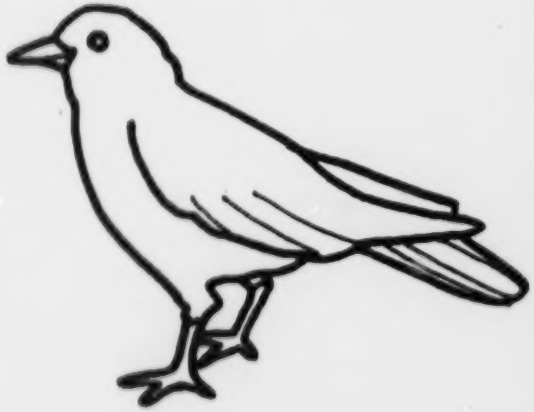
9. Put water into three small containers. Add several drops of red food coloring to one container, several drops of yellow food coloring to another container, and several drops of blue food coloring to another container. Let children use eyedroppers to drop colored water onto round, flattened coffee filters. Some of the colors will mix and form new colors.

10. Provide different combinations of paint for the children to try each day: blue and yellow, red and yellow, red and blue.

Session 4: Gears help us do work.

1. Let children explore with the Wonderwheels. Encourage children to try the gears in various places. Talk to children about how the teeth in the gears must meet in order to work.

2. Bring in common objects that use gears to work (egg beaters, can openers) and let children explore with them.



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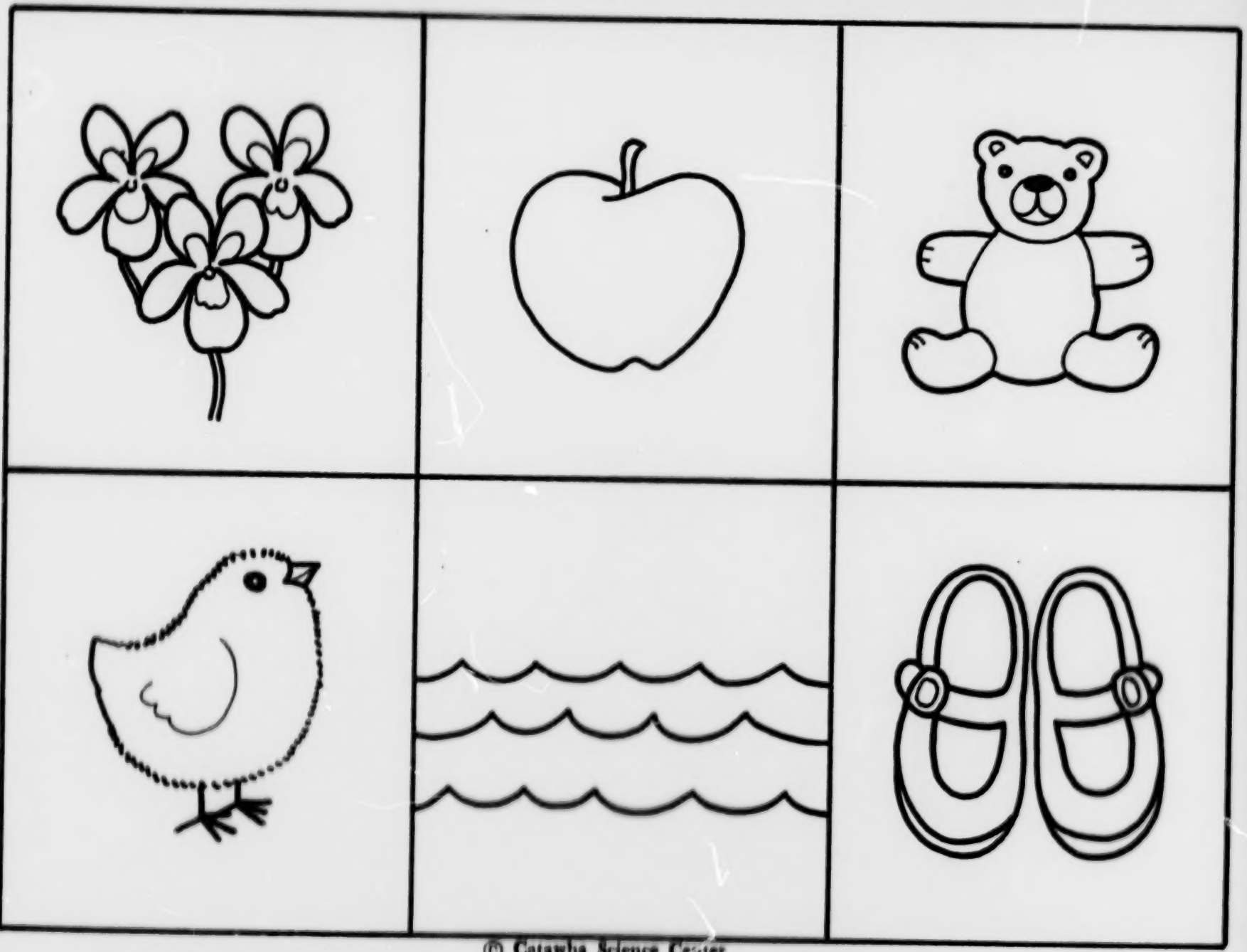

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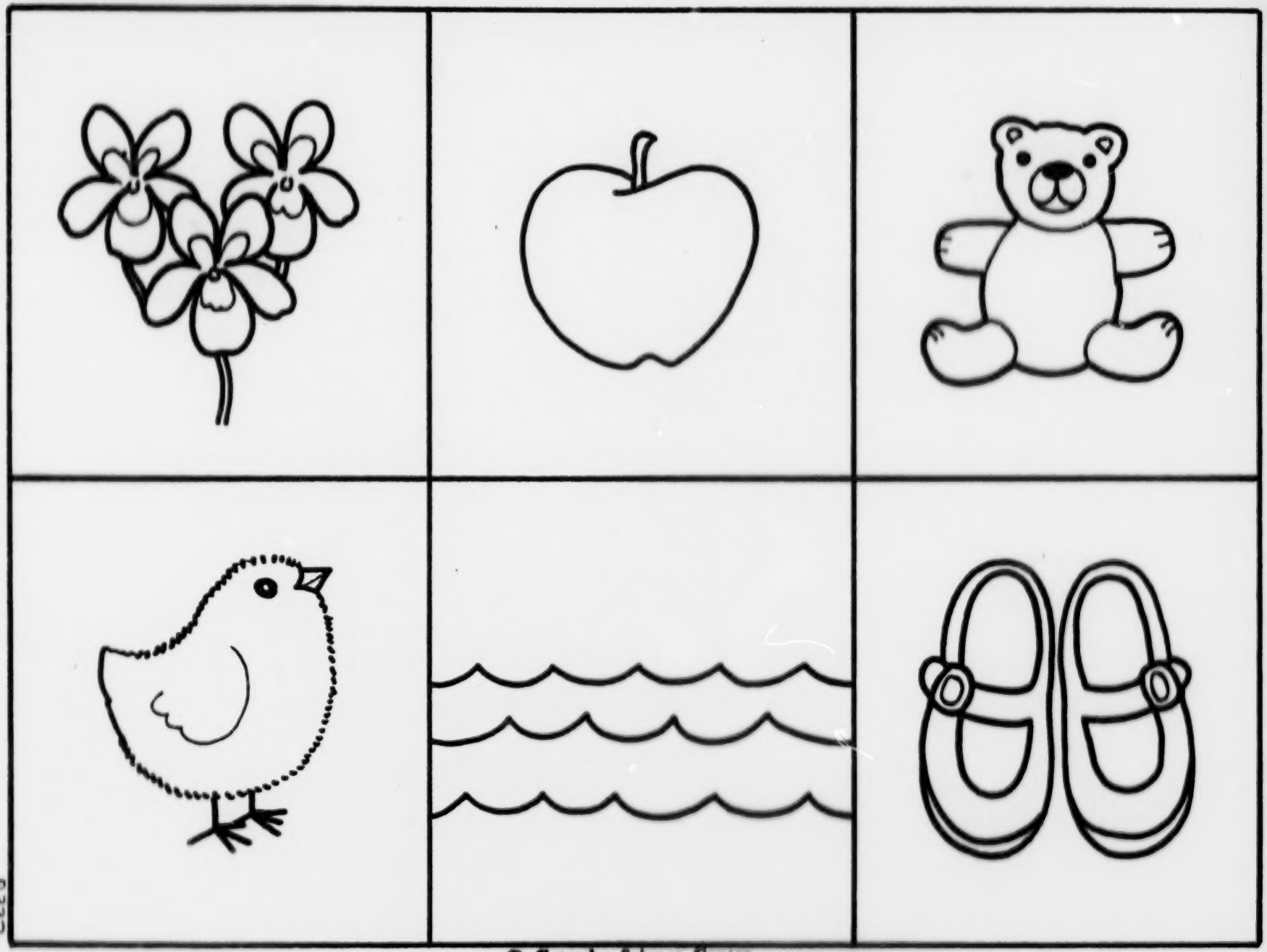

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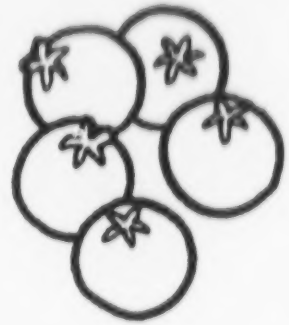

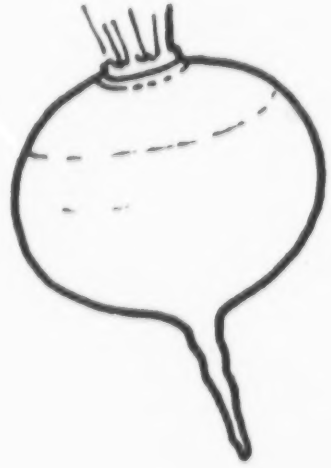

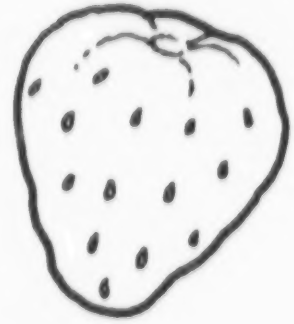

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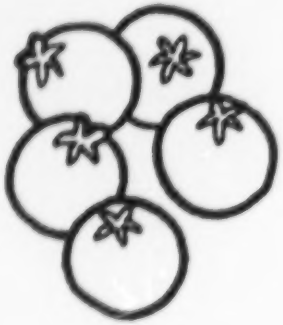

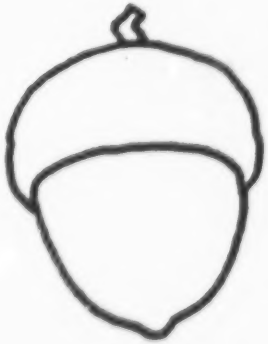

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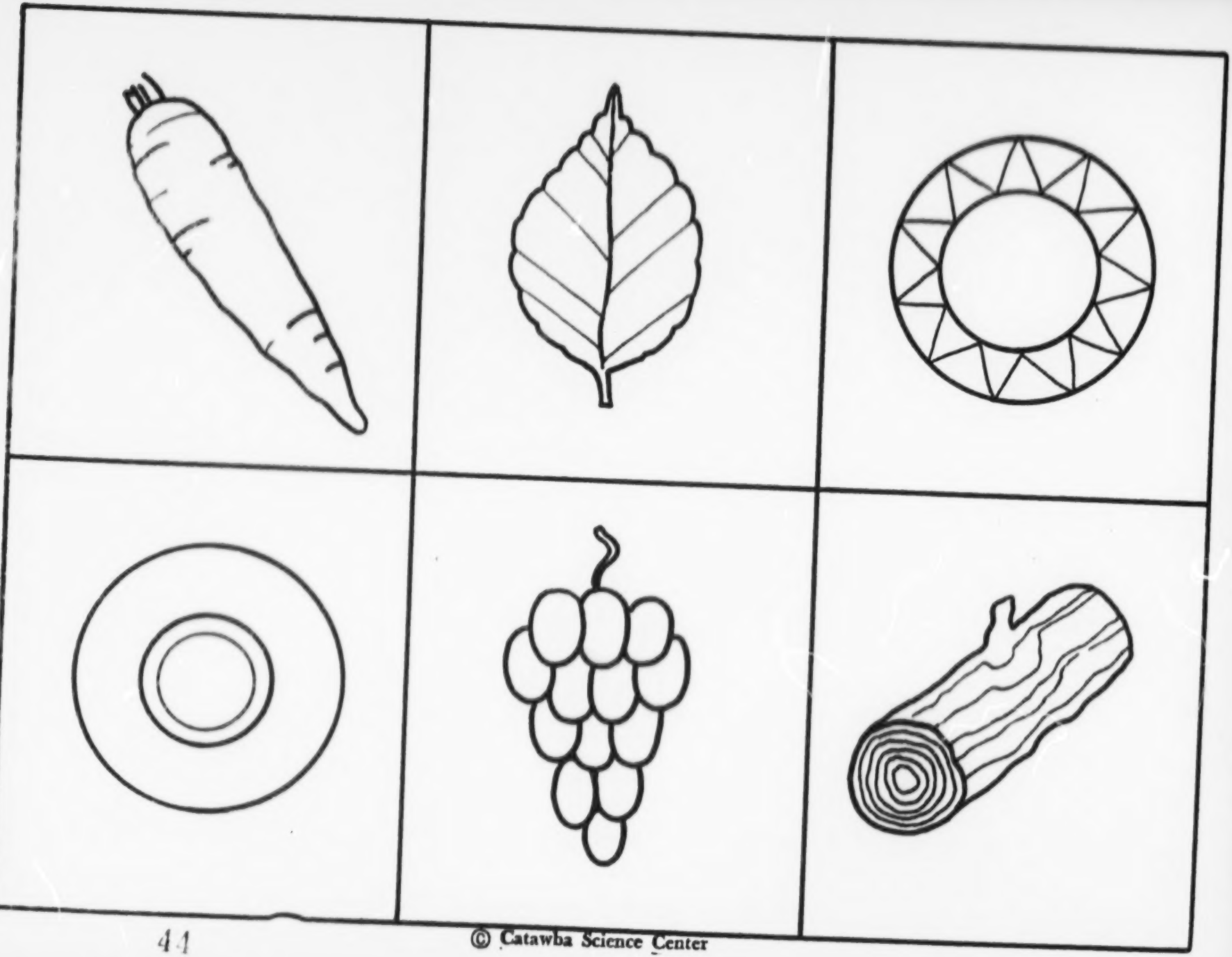

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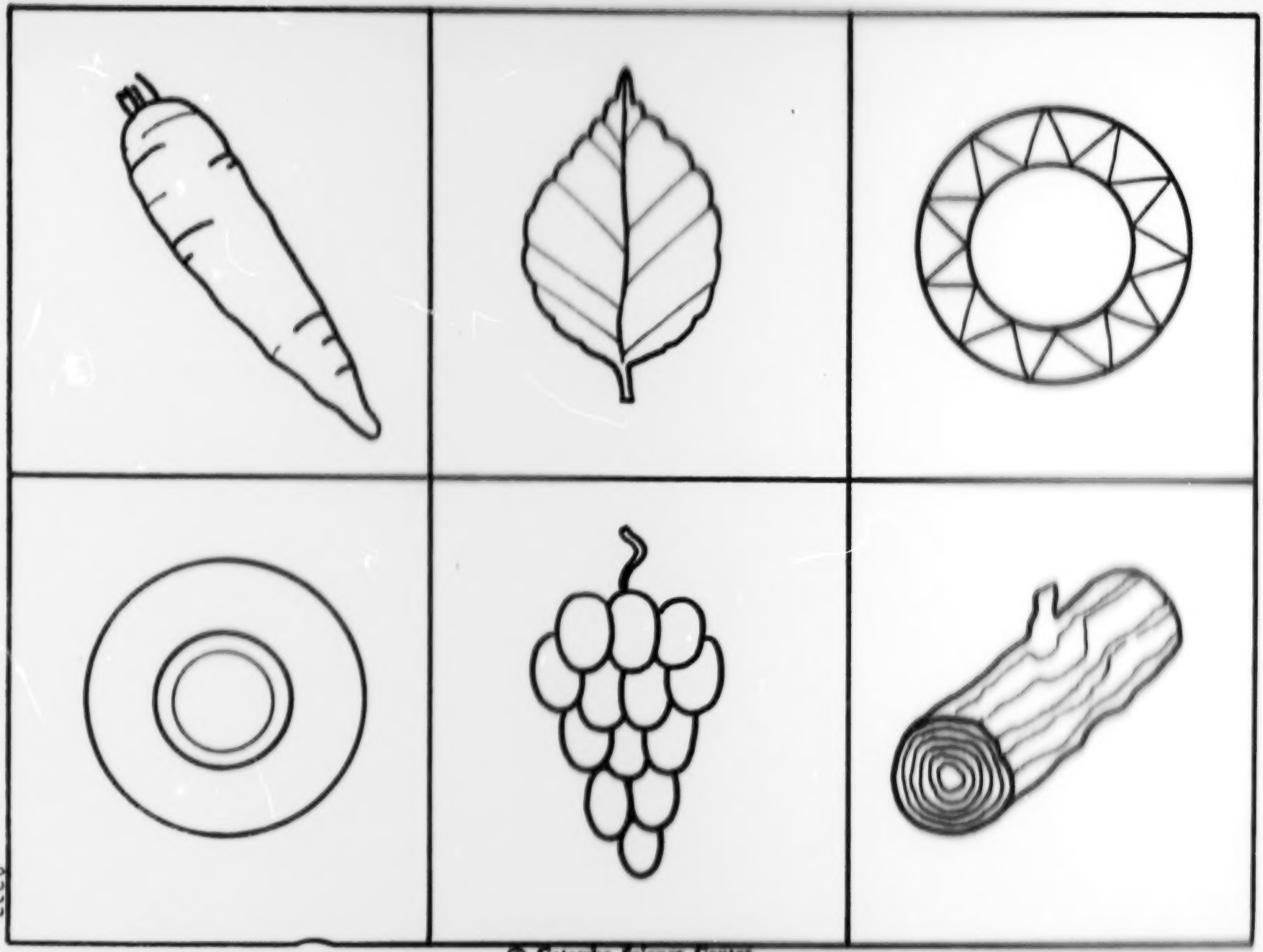

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Fantastic Physics

Books and Fingerplays

Three-Year-Olds
Four-Year-Olds

Physics
Books

Switch On, Switch Off **written by Melvin Berger**

Light **written by Donald Crews**

Shadow **written by Blaise Cendrars**

Shadows: here, there and everywhere **written by Ron Goor**

My Shadow **written by Sheila Gore**

Shadow Magic **written by Seymour Simon**

I Have A Friend **written by Keiko Narahashi**

Machines At Work **written by Byron Barton**

Color Seems **written by Ilma Haskins**

Is It Red? Is It Yellow? Is It Blue? An Adventure in Color **written by Tana Hoban**

Colors **written by Shirley Hughes**

Light and Color **written by L.W. Anderson**

Shadow Magic **written by Simon Seymour**

Light **written by Angela Webb**

Discovering Electricity **written by Rae Bains**

Mickey's Magnet **by Franklyn M. Branley and Eleanor K. Baughn**

Look at Magnets **written by Rena K. Kirkpatrick**

Machines **written by Anne and Harlow Rockwell**

Energy From the Sun **written by Melvin Berger**

True Book of Magnets and Electricity **written by Illa Podendorf**

Story of Electricity **written by Mae B. Freeman and Ira M. Freeman**

Electricity **written by Edward Victor**

Electricity: A book to begin on **written by Leslie Waller**

Look in the Mirror **written by Sam and Beryl Epstein**

Mirror on the Wall: How it Works **written by Phillip B. Carona**

What Is Light? **written by Theodore Munch**

The First Book of Color **written by Herbert P. Paschell**

Color My World **written by Wayne Carley**

Light and Dark **written by Seymour Simion**

Fantastic Physics
Songs and Fingerplays
Resources

More Piggy Back Songs by Jean Warren, 1984
See My Shadow
Oh Rainbow, Oh Rainbow

Piggy Back Songs by Jean Warren, 1984
My Favorite Machine

The following fingerplays/songs were written by Karla Payne, MA.

Do You See Your Shadow? (Sung to "Mary Had A Little Lamb")

Do you see your shadow, shadow, shadow?
Do you see your shadow,
There on the ground?

Yes, I see my shadow, shadow, shadow,
Yes, I see my shadow,
There on the ground.

I don't see my shadow, shadow, shadow,
I don't see my shadow.
The sun has gone away.

Did You Ever See A Magnet? (Sung to "Did You Ever See A Lassie?")

Did you ever see a magnet attract and repel?
Attract and repel, attract and repel?
Did you ever see a magnet attract and repel?

Did you ever see a magnet attract and repel?
It pushes and pulls, it pushes and pulls.
Did you ever see a magnet attract and repel?

This is the Way the Gears Turn (Sung to "Here We go Round the Mulberry Bush")

This is the way the gears turn, gears turn, gears turn.
This is the way the gears turn to help us do our work.

The gears make the motor work, motor work, motor work.
The gears make the motor work, as they help us do our work.

The gears make the pieces turn, pieces turn, pieces turn.
The gears make the pieces turn, as they help us do our work.

This is the Way That Light Helps Us (Sung to "The Mulberry Bush")

This is the way the light helps us, light helps us, light helps us.
This is the way that light helps us, it helps us see so many things.

This is the way the light helps us, light helps us, light helps us.
This is the way that light helps us, it helps us see all the colors.

This is the way the light helps us, light helps us, light helps us.
This is the way that light helps us, it helps us see in the mirror.

Batteries Help Us (Sung to "Frere Jacques")

Batteries help us, batteries help us
To make things work, to make things work,
They help us make our toys run, they help us make our toys run,
They help us to have fun, they help us to have fun.